



## Antireflective nanostructures replicated from black silicon

Christiansen, Alexander Bruun

*Publication date:*  
2013

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Christiansen, A. B. (2013). *Antireflective nanostructures replicated from black silicon*. Abstract from International Symposium on Nanoscale Pattern Formation at Surfaces, Copenhagen, Denmark.

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Names (Example): Alexander Bruun Christiansen, Ph. D. Student  
Affiliation: NSE Optofluidics, DTU Nanotech  
Strategic research field: Materials and fabrication



## Antireflective nanostructures replicated from black silicon

Can expensive multilayer antireflective coatings for e.g. glasses and camera objectives be replaced by cheap nanostructured surfaces? Inspired by the moth's eye, we fabricate cone-shaped nanostructures in silicon, that significantly reduce Fresnel reflections from the surface – "black silicon" (Figure 1, top). The structures are easily fabricated on large areas using a reactive ion etching, and replicated intoOrmocomp – a transparent glass/polymer hybrid material.

The random nature of the black silicon nanostructures will inherently scatter the light, rendering theOrmocomp surface milky-white. However, by tuning the etching process to make the nanostructures small enough, we can avoid scattering in a large part of the visible spectrum, and the structured surface becomes transparent (Figure 1, bottom right).

Using Fourier analysis of SEM images of the surfaces we can determine the dominating spatial period of the surfaces. Combined with optical measurements, we conclude that structures with a dominating spatial period of 160 nm, a height of 200 nm, and aspect ratio of 1.3 show insignificant scattering of light with wavelength above 500 nm and lower the reflectance by a factor of two.

Link: <http://dx.doi.org/10.1063/1.4754691>

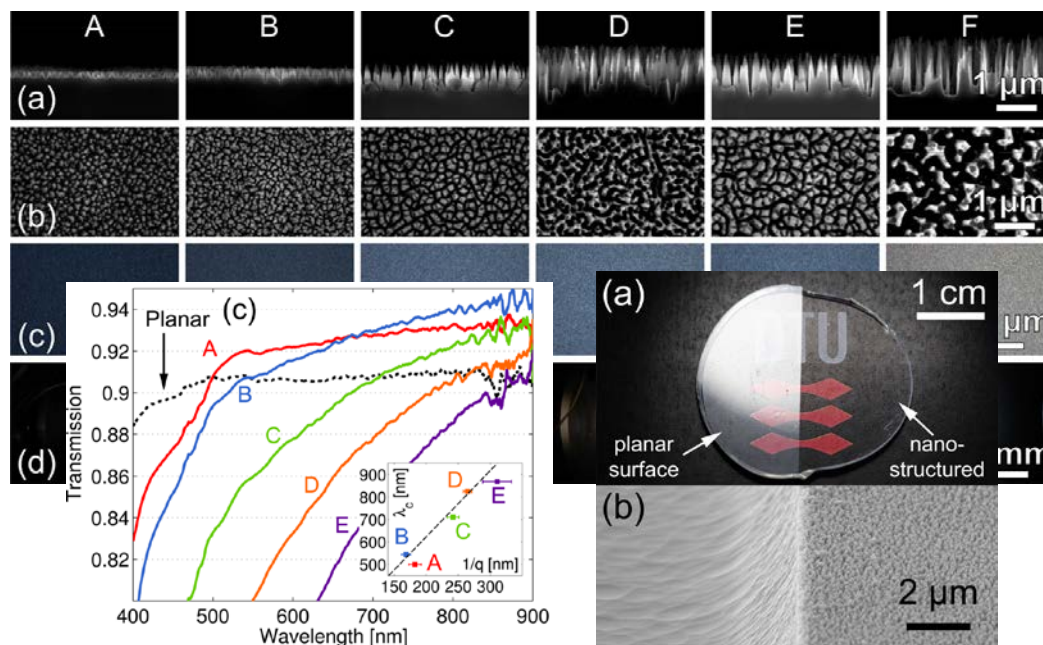


Figure 1. Top: Different types of black silicon. Bottom left: Direct transmission measurements of Ormocomp samples with antireflective structures on one face. Inset: Wavelength at intersection between transmission spectra of planar and structured surfaces,  $\lambda_c$ , as a function of the dominating structural periods,  $q^{-1}$ . Bottom right: Photograph of Ormocomp sample with antireflective nanostructures on top and bottom face, placed on a sheet of paper with a printed logo. Nanostructures are on the right side of the transparent sample. (b) SEM image of the sample, showing the difference between the planar (left) and the nanostructured surface (right).